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Colorado Department of Public Health and Environment

July 25, 2012

To Public Water Systems

Subject: General requirements of membrane filtration technologies as Alternative Filtration Technologies for meeting the *Colorado Primary Drinking Water Regulations* (CPDWR) requirements for *Giardia lamblia* and *Cryptosporidium* Removal

To Whom It May Concern;

The Water Quality Control Division (the Division) reviews and accepts specific membrane technologies as Alternative Filtration Technologies in accordance with Article 1.11.2, Article 7.2.3 (c), and Article 7.3.4 (c) of the *Colorado Primary Drinking Water Regulations* (CPDWR). The Division issues a specific acceptance memorandum to manufacturers for each membrane module capable of demonstrating its ability to consistently meet the treatment requirements following submission and review of supporting documentation. To date, the Division has accepted membrane technologies as Alternative Filtration Technologies from the following manufacturers:

- GE-Zenon
- Kruger/Metawater
- Norit X-Flow
- Pall
- Siemens
- WesTech
- Hydranautics

The Division has the authority to set turbidity performance criteria for Alternative Filtration Technologies per Articles 7.2.3(c) and 7.3.4(c) of the CPDWR which state

> *".....the Department will set turbidity performance requirements that the system must meet at least 95 percent of the time and the system may not exceed at any time at a level that consistently achieves 99.9 percent removal and/or inactivation of Giardia lamblia cysts, 99.99 percent removal and/or inactivation of viruses, and 99 percent removal of Cryptosporidium oocysts."*

In all of the previous acceptance documents for membrane filtration manufacturers, the Division has required the following performance criteria

Turbidity Performance Standards	< 0.1 NTU 95% of the time Not to exceed 0.5 NTU

This letter serves as notification of an **error** in the above Turbidity Performance Standards. **The less than (<) symbol should in actuality be a less than or equal to (≤) symbol.** The Division will be re-issuing all of the acceptance documents for the above manufacturers in order to clarify this issue. **The new turbidity performance standards will be:**

Turbidity Performance Standards	**≤ 0.1 NTU 95% of the time** **Not to exceed 0.5 NTU**

Note: Because the standard is set at 0.1 NTU and the requirement is to be less than or equal to this value, the finished water turbidity must register at or above 0.15 NTU greater than 5% of the time for a violation to be issued. This allowance has to do with rounding and significant figures associated with the 0.1 NTU standard. With only one significant figure, a registered value of 0.149 rounds **down** to 0.1 and 0.150 rounds **up** to 0.2.

The Division is also aware that a subset of water systems are operating under Division approval as membrane systems, but were approved prior to an Alternative Filtration Technology acceptance for their specific membrane module . If a water system has been operating under an approval that pre-dates the Alternative Filtration Acceptance process, the system has been issued Compliance Schedules from the Division setting a 95% turbidity limit of 0.3 NTU in accordance with Table 7-3 and 7-4 of the CPDWR.

This letter serves as formal notification that ALL membrane systems, regardless of when they were approved, shall receive the following removal credits for their membrane filtration process:

Compliance Log-Removal Credit Granted to meet the requirements of the CPDWR *	
Giardia lamblia	3.0 – Log
Cryptosporidium	3.0 – Log
Virus	no credit granted
Membrane filters which were approved at individual public water systems prior to the Alternative Filtration Acceptance process may be used as final compliance filters as part of a multiple treatment barrier approach to meeting SWTR requirements (Article 7, CPDWR). In addition to the above filtration, the water system MUST provide a minimum of **4.0-Log virus inactivation** by disinfection. The Division does not offer virus removal credit to any microfiltration, ultrafiltration, NF or RO because of the requirement to maintain multiple barriers for pathogens. Also, please note that the Division will evaluate any additional filter log removal credit and compliance monitoring criteria for systems that are classified as Bin 2 or higher as part of Article 7.4 of the CPDWR on a case- by-case basis. *** NOTE:** Compliance credit awarded is merely for meeting minimum requirements of the CDPWR Article 7 (Surface Water Treatment Rules - SWTR) and does NOT reflect demonstrated performance of the micro or ultrafiltration system in any way. Actual removals in these types of systems can frequently exceed 4.5-5.0 log removal of *Giardia, cryptosporidium,* or testing surrogates. The Division highly recommends that water systems compare manufacturer literature to determine the absolute performance of any system selected.	

In addition, all membranes, regardless of when they were approved, are expected to meet the following performance requirements:

Turbidity Performance Standards	**≤ 0.1 NTU 95% of the time** **Not to exceed 0.5 NTU**
Direct integrity testing frequency	**1X per calendar week that the membrane is in operation and immediately following a chemical clean in place (CIP)**

The justification for requiring the lower turbidity performance standard is as follows. The State of Colorado is unique in its approach to membranes; the Division allows public water systems to perform direct integrity testing once per calendar week. All other states, to our knowledge, mandate all public water systems regardless of bin classification to continuously meet all the requirements set forth in the Long Term 2 Enhanced Surface Water Treatment Rule (Article 7.4 of the CPDWR) including: daily direct integrity testing, log removal calculations, the indirect integrity testing requirements, and others. In addition, Colorado is the only state which sets the compliance removal credit of *Giardia* at 3.0 log for membrane systems. The implication is then that the public water system is not required to disinfect to achieve additional log inactivation of *Giardia* but rather must show 4.0 log inactivation of viruses in the disinfection process. This too is unique amongst states, which typically require an additional disinfection barrier with membranes to achieve 0.5 log inactivation of *Giardia.* Given these concessions, which the Division believes makes membrane technology more accessible to small systems, the Division requires lower turbidity limits. Also, in the vast majority of cases, membrane facilities do not and should not struggle to meet the lower turbidity limit of achieving ≤0.1 NTU more than 95% of the time.

This acceptance applies only to the use of membrane filtration for compliance with Article 7 of the CPDWR (the surface water treatment rules). It does NOT constitute construction approval for installation at individual public water systems. **Public water systems must submit for individual review and approval to use this technology. Each approval will be handled on a case-by-case basis by the Division as required by Article 1.11.2 of the CPDWR.**

Please direct any further correspondence regarding this acceptance to:

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Water Quality Control Division
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If you have any questions or comments, please call Tyson Ingels at 303-692-3002.

Sincerely,

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Lead Drinking Water Engineer
Engineering Section
Water Quality Control Division

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CDPHE – WQCD-FS
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